11:45

704-6 Chronic Exercise Training Restores Endothelium-mediated Control of Epicardial Coronary Artery During Development of Heart Failure in Awake Dogs

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The beneficial effects of exercise training (EX) in patients with heart failure have been reported but the underlying mechanisms are still unknown. The objective of this study was to determine the potential beneficial effects of chronic EX on endothelium-mediated dilation of epicardial coronary artery in awake dogs during development of heart failure. Dogs were chronically instrumented for measurements of left ventricular pressure, aortic pressure, and epicardial coronary artery diameter (CD, sonomicrometer) and for chronic pacing. The dogs were allowed to recover and experiments were performed in conscious state. Dogs were cardiac paced (210 b/min for 3 weeks and 240 b/min for the 4th week), and were trained to run on a treadmill two hours/day at speed of 5.8 ± 2.2 kms/hour (one hour in the morning and one hour in the afternoon) during this 4 week pacing period. Experiments were performed before and after this 4 wk period. Following release of 5, 10, 15, 20 and 30 second coronary artery occlusion, CD dilated 4.2 ± 1.0%, 5.63 ± 1.4%, 5.94 ± 1.5%, 6.74 ± 1.0% and 7.04 ± 1.2% vs 4.35 ± 1.0%, 5.55 ± 1.3%, 5.85 ± 0.82%, 6.23 ± 0.61% and 6.36 ± 0.69% ($p > 0.05$) before and after EX plus pacing, respectively. The responses of CD to acetylcholine at doses of 0.25, 0.5, 1, 5, 10 and 20 μg/kg were also preserved: 2.22 ± 1.3%, 2.76 ± 1.8%, 4.26 ± 1.7%, 6.59 ± 1.32%, 7.15 ± 1.21%, 7.64 ± 1.15% vs 2.57 ± 1.6%, 2.28 ± 0.99%, 4.37 ± 1.89%, 6.37 ± 0.85%, 6.72 ± 0.97%, 6.82 ± 0.51%, respectively ($p > 0.05$). Nitroglycerin-induced dilation of CD was not altered. In contrast, endothelium-mediated vasodilation is enhanced after chronic EX in normal dogs and is eliminated in dogs with pacing-induced heart failure. Thus, chronic EX protected endothelium-mediated dilation of epicardial coronary artery during development of heart failure. This might be due to EX normalized production of endothelial-derived relaxing factor.

705 Ventricular Tachycardia: Catheter Ablation

Monday, March 20, 1995, 10:30 a.m.–Noon
Ernest N. Morial Convention Center, Room 14

10:30

705-1 Radio Frequency Lesion Depth vs. Width Maturation: Two Contrasting Parameters

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Catheter to tissue contact, RF power level, and RF application time are factors that define the rate of lesion growth and final lesion size. In this investigation of the determinants of lesion width (W) and depth (D), we attempted to define optimal requirements to maximize lesion depth. In 5 dogs LV free wall epicardial lesions were generated with 10, 20, 30, 40, and 50 watts of RF power applied with a temperature-monitoring 4 mm tip ablation electrode. The lesions were created with the catheter tip electrode contacting the tissue at various levels. The catheter tip was pressed 3 mm (+3) and 1 mm (+1) into the epicardium or placed lightly over the epicardium (0). The RF application time was varied from 10–120 sec. The heart and electrode were immersed in circulating blood at a constant temperature of 37 °C. The width of the lesion matured within 10–20 seconds for the largest lesions [W = 9.3 ± 1.3 mm at 50 watts and +3 contact, *W = 8 ± 0.7 mm with +1 contact, and *#W = 6.3 ± 1 mm with 0 contact (* $p < 0.05$ vs. +3 contact; # $p < 0.05$ vs. +1 contact)]. The overall maximum lesion depth (9.2 ± 1.2 mm) was measured with +3 contact and 20 watts of power applied for 100 sec. With +1 contact, the greatest lesion depth (8.7 ± 2 mm) was the result of 40 sec of 30 watt RF power. At 0 contact, the maximum depth (8 ± 0.7 mm) was obtained with 30 watts applied for 100 seconds. At 40 and 50 watts, 70% of the lesions were terminated by rapid impedance rise 10–30 sec after the intiation of RF application. At all contact and power levels, lesion depth was significantly smaller if the power application was terminated before 40 sec (D = 6.1 ± 1.3 mm, $p < 0.05$ vs. 60 sec or greater).

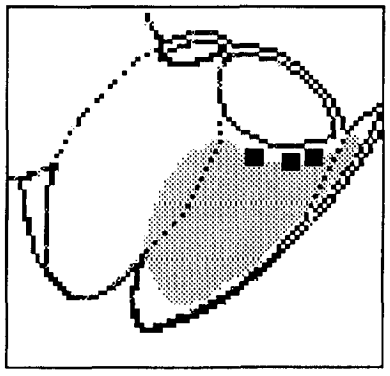
Conclusions: (1) Lesion width matured within the first 20 sec of power application for all power and contact levels. (2) Over 1.5 minutes of power application is required for deeper RF lesions to mature. (3) The use of power levels of 40 or 50 watts often results in an impedance rise before depth maturation. (4) Since contact level is not known prior to power application, the power level should be limited to 20–30 watts or less and applied for 1.5 minutes.

10:45

705-2 Catheter Ablation of the Mitral Isthmus for Ventricular Tachycardia Associated with Inferior Infarction

David Wilber, John Kall, Douglas Kopp, Dennis Glascock, Charles Kinder. *University of Chicago, Chicago, IL*

Catheter ablation (CA) of ischemic sustained monomorphic ventricular tachycardia (SMVT) remains problematic due to the presence of multiple potential functional circuits. We identified 3 pts with SMVT and a posterior akinetic/dyskinetic segment in whom anatomic constraints on the reentrant circuit facilitated CA. Each pt had 2–40 episodes of spontaneous SMVT in the previous month despite amiodarone. SMVT had either a LBBB (rS in V1, R in V6) right superior axis morphology (M), or a RBBB (R in V1, QS in V6) left superior axis M. Both M were reproducibly induced in each pt (cycle length [CL] 600–320 ms). In each pt, both M appeared to share a similar slow conduction zone in the inferobasal left ventricle adjacent to the mitral valve annulus. During SMVT of either M, these sites were characterized by diastolic potentials with electrogram-QRS intervals of 115–251 ms (24–58% of SMVT CL) and concealed entrainment during pacing associated with stimulus-QRS intervals of 105–411 ms (23–92% of SMVT CL). Application of radiofrequency energy (50 W for 90–120 s) at one of these sites in each pt (figure) resulted in termination of SMVT within 2–12 complexes. Following CA, neither M could be induced in any pt. In 1 pt, SMVT with a third nonclinical QRS M (CL 250 ms) remained inducible. All pts had implantable defibrillators with RR interval and/or electrogram storage. During 1–5 mo follow-up, no pt has had spontaneous SMVT or shocks. *Conclusions:* An isthmus of surviving myocardium adjacent to the mitral valve annulus may constitute a critical region of slow conduction in some pts with inferior MI and recurrent SMVT, providing a vulnerable and anatomically localized target for CA. Characteristic SMVT morphologies may identify candidates for this approach.



11:00

705-3 Initial Experience with Left Ventricular Endocardial Catheter Manipulation Guided by Intracardiac Ultrasound Visualization: Improved Accuracy Over Fluoroscopic Imaging

Rodrigo C. Chan, Susan B. Johnson, James B. Seward, Douglas L. Packer. *Mayo Foundation, Rochester, MN*

The accuracy of radiofrequency ablation catheter tip localization with reference to surrounding anatomy was examined with both fluoroscopic and intracardiac long axis ultrasound imaging modalities in the canine left ventricle. 72 lesions (5–6 per dog) were created in 14 dogs with the delivery of 20–65 watts of radiofrequency power via 4–12 mm tip catheters. Using a 9 RAO and 9 LAO mapping zone grid system, the relationship between fluoroscopic catheter tip position and underlying anatomy was established. The catheter tip location predicted by the fluoroscopic approach correlated precisely with the specific post-mortem lesion location in 52 (72%) of lesions. In 18 (25%), the lesions were found to be one zone (1–2 cm) removed from the predicted site and were ≥2 zones removed in 2 (3%) lesions. Locations predicted by longitudinally imaging intracardiac ultrasound as referenced to papillary muscles, the interventricular septum, and aortic and mitral annulae were significantly more accurate ($chi^2 = 7.1$, $p = 0.029$) than with fluoroscopy. In each of 20 sites examined, the lesion was within 5 mm of that predicted by intracardiac ultrasound localization. This information demonstrates that ultrasound guidance during catheter mapping may be superior to that possible with fluoroscopy. This is of importance for the localization of tachycardia circuits, the investigational localization of radiofrequency lesions created with catheter techniques, and for return site energy delivery in cases of unstable or only marginally reproducible tachycardias.

MONDAY AM